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(54) Electrically heated fabric articles

(57) An electrically heated fabric article, particularly a garment such as a mitten, is provided with an inner lining (1) and an interlining of flexible metallised fabric forming a resistance heating element (2, 3) shaped so as to be capable in use of generating, for each point on a surface of the article, an amount of heat corresponding to the heat requirements at that point. The metallised fabric may be stretchable and its thickness may be varied from point to point to vary its resistivity. Electrical supply cable connections (4) may be secured by strain relief clamps.

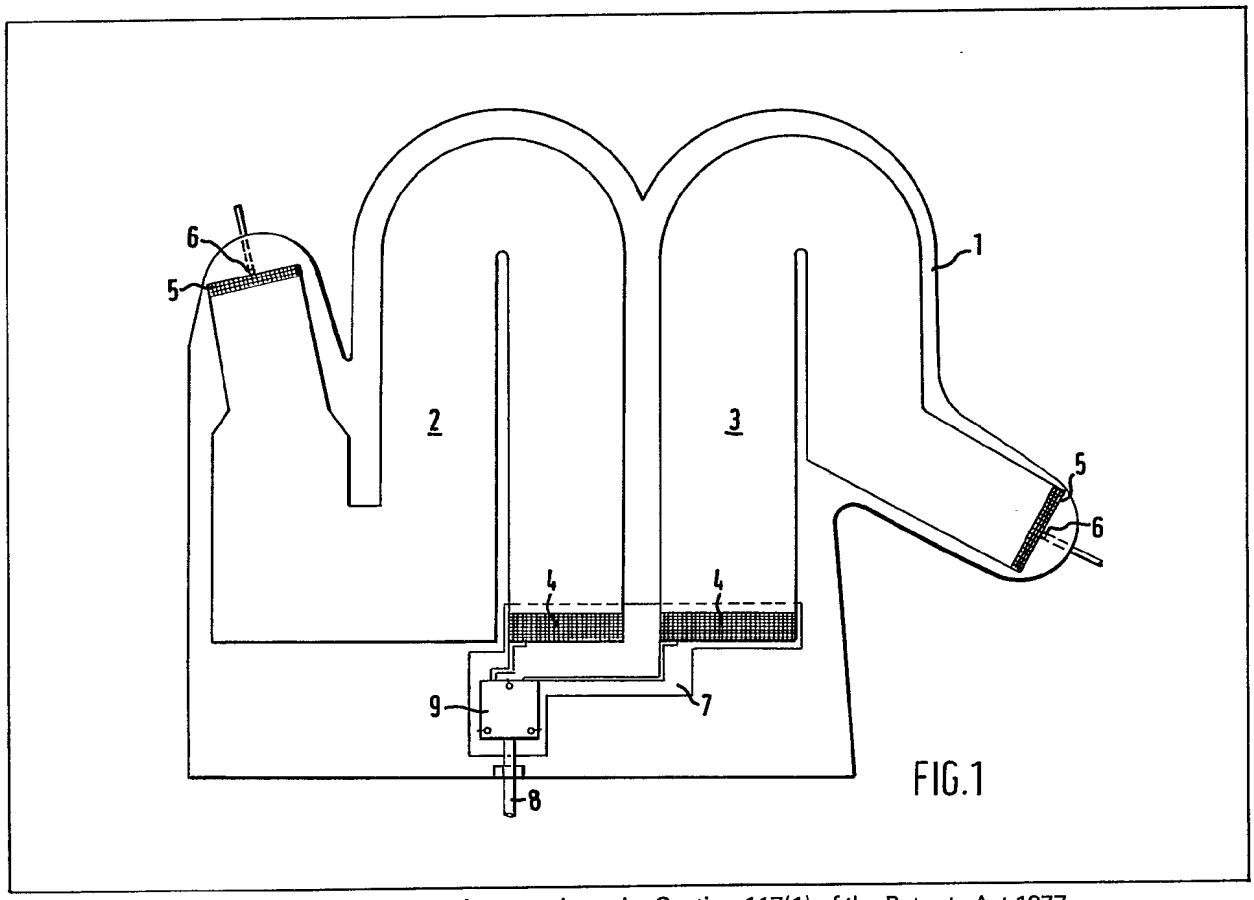

FIG.1

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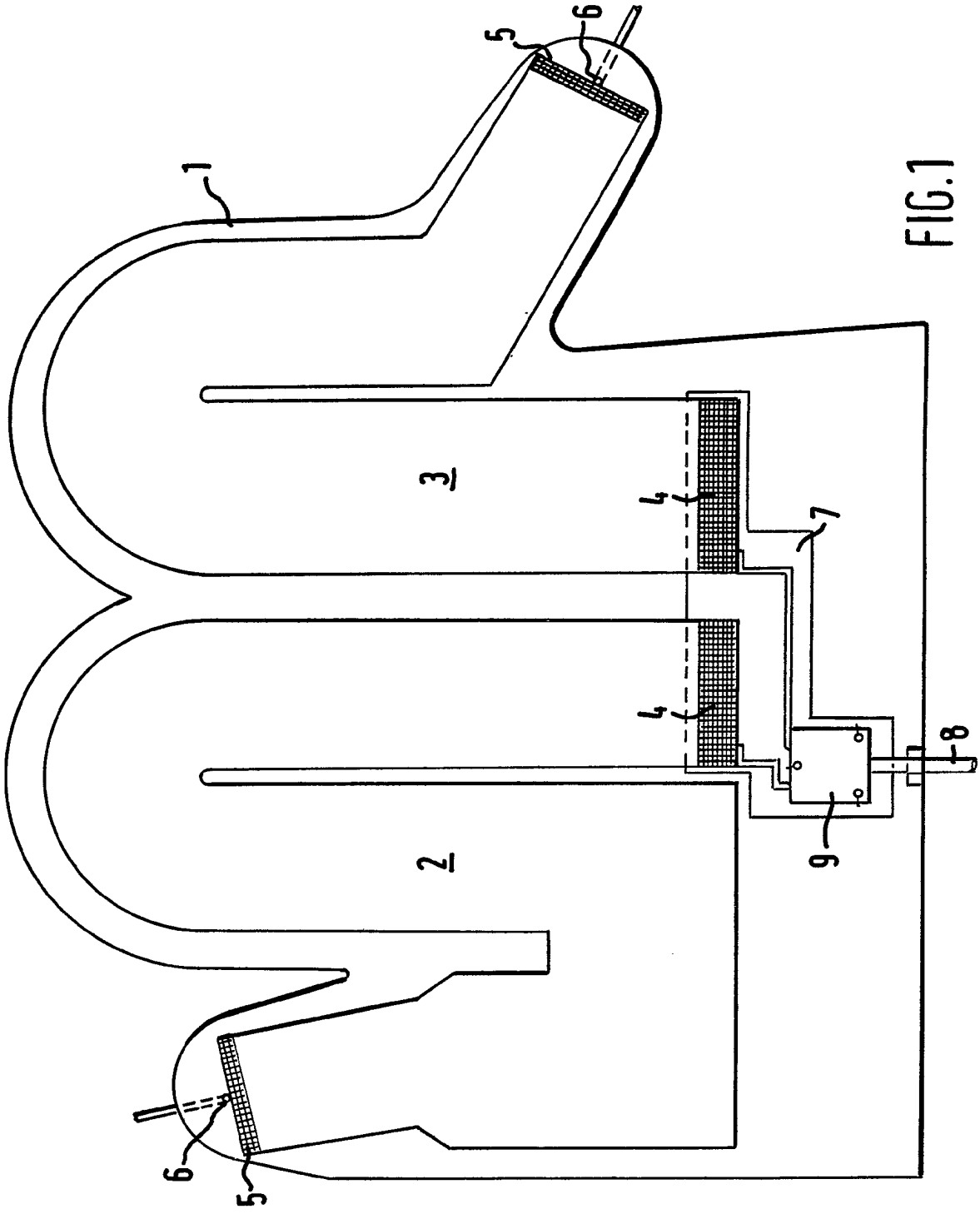


FIG.1

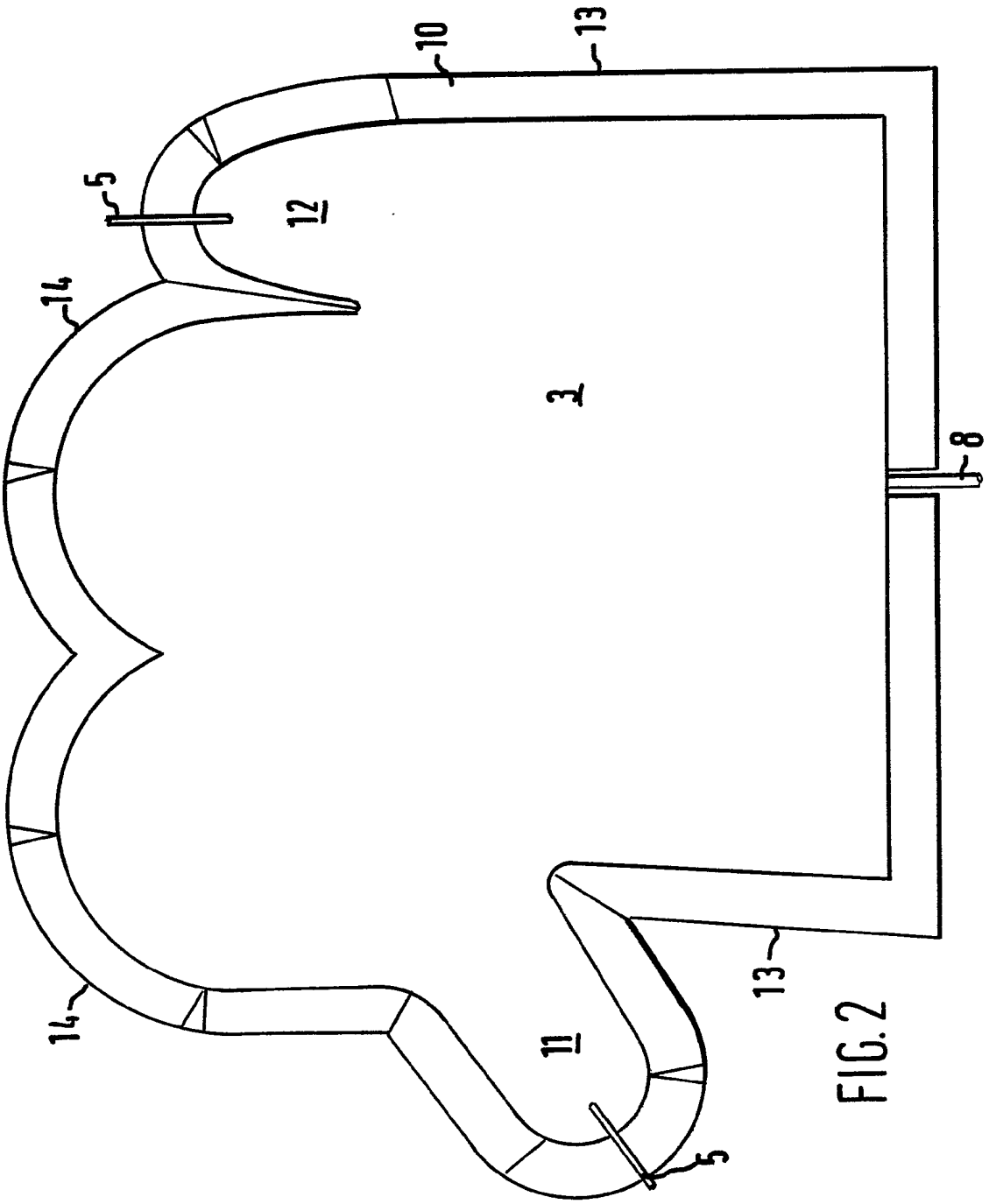


FIG.2

FIG.3

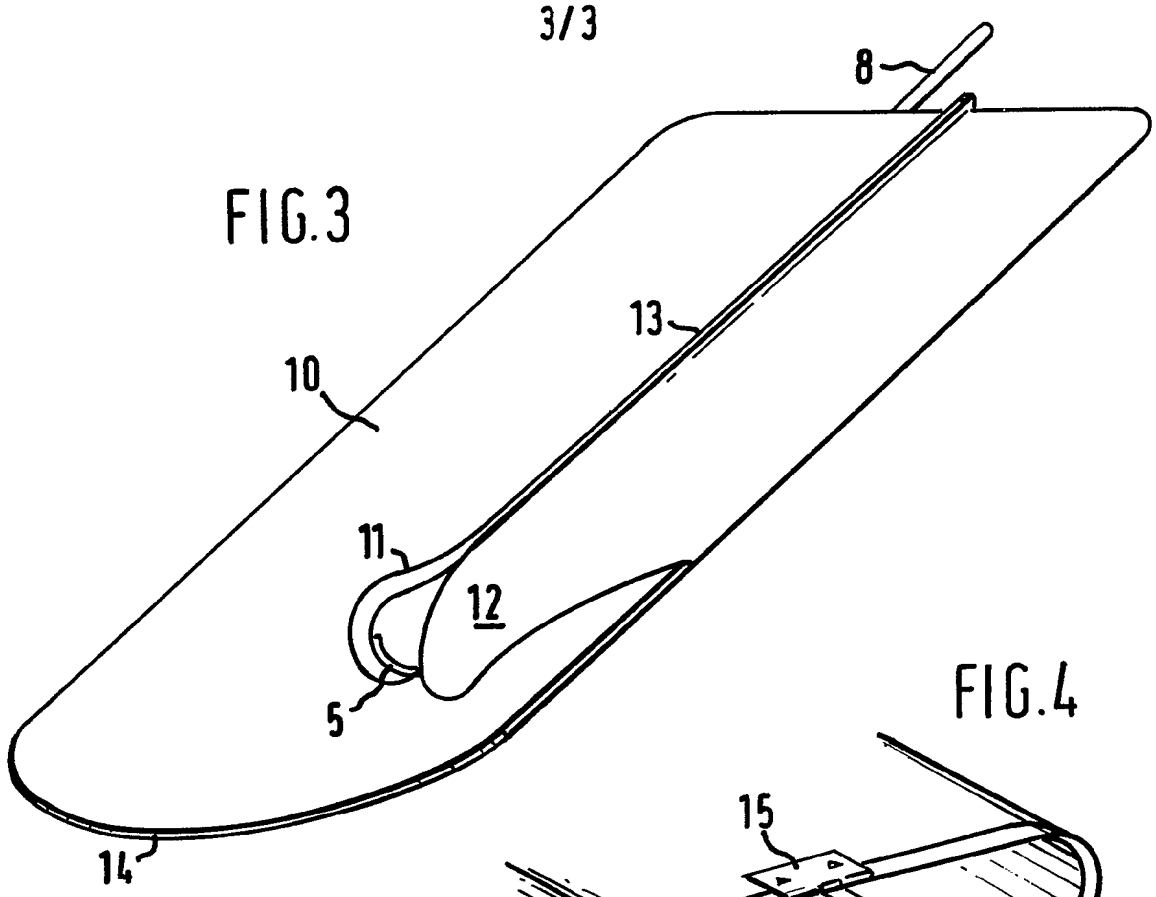
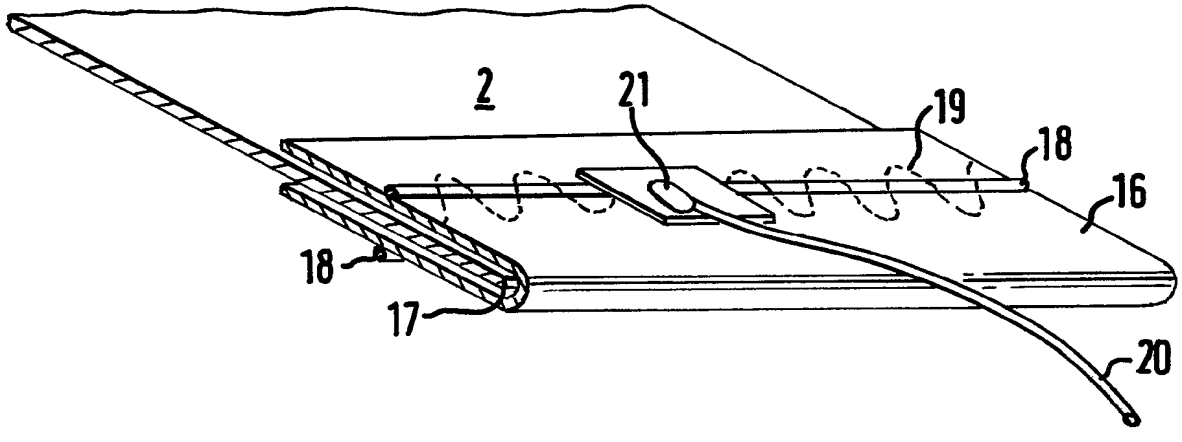


FIG.4

FIG.5



SPECIFICATION

Electrically heated fabric articles

This invention relates to electrically heated fabric articles, particularly garments but including blankets for example, of the kind which incorporates in their structure an electrical heating element of such a resistance that supply of current from a relatively low safe voltage e.g. not more than 48 volts, can generate a required amount of heat.

Known articles of this kind incorporate wire heating elements and have the disadvantages of high manufacturing cost, locally intensive heating, and the liability of the element to break through flexing, when the broken wires can subsequently damage the support fabric. Also, connections of wire heating elements to terminals are known to fail due to wire fatique fracture at the point of connection.

It is also known to use a flexible metal foil as the heating element, the foil having the form of a printed circuit produced, for example, by photo-etching.

The present invention provides a heating element for such articles so that the articles have a lower manufacturing cost, have a more even and controllable distribution of temperature, and have a greater reliability against failure of the electrical circuit.

According to the invention, an electrically heated fabric article is provided with an interlining of flexible metallised fabric providing a resistance heating element shaped so as to be capable in use of generating, for each point on a surface of the article, an amount of heat substantially corresponding to the heat requirements at that point.

The metallised fabric interlining may be of woven, felted or otherwise non-woven fibrous material which has been coated or impregnated, such as by vapour deposition or otherwise, with a metal, such as nickel, of good conductivity, so that a relatively small amount of metal is required to make the material as a whole electrically conductive. The fibres may be metallised before or after spinning, weaving, felting or other making-up into fabric.

The advantage of using metallised fabre fabric as the electrical heating element are that is forms a broad conducting band that is not easily broken, as are wires, and that such a fabric retains to a high degree many of the mechanical properties of the unmetallised fabric and is therefore highly suited for use in fabric articles.

Because the heating element is so much broader than a corresponding wire element the heating is produced more evenly and by varying the width of the conductive band, for a given thickness, the local resistance, and hence heating effect, can be varied, a suitable resistivity being approximately 1 to 2 ohm cm^{-2}.

The metallised fabric may be made stretchable, either elastically or permanently, so that the local resistance of parts thereof may be varied, temporarily or permanently, by local stretching resulting in reduction of cross-sectional area and hence increased electrical resistance and heating effect.

Fabrics having differing loadings or concentrations of metallisation, and hence differing resistivities, may additionally or alternatively be incorporated at different parts of the article to provide local generation of the requisite amount of heat.

One embodiment of the invention is shown in the accompanying drawings of an electrically heated mitten in stages of its manufacture, Figs. 1 and 2 being somewhat diagrammatic plan views, Fig. 3 a perspective view of a mitten ready to be sewn up and Figs. 4 and 5 perspective detail views of a strain relief clamp and an alternative connection.

Fig. 1 shows a piece of glove or mitten lining material cut to form an inner lining 1, with a stitched-on interlining of sinuous pattern metallised fabric heating elements 2, 3 each having stitched-on tinned copper mesh and braid connections 4, 5, the connections 5 passing through holes 6 to the other side of the inner lining 3. Under the connections 4 is a pad 7 of wear-resistant material. A power supply cable 8 is soldered to the connections 4 and a terminal cover box 9 is placed over the cable-connection junction and stitched in place on the pad 7.

Fig. 2 shows the assembly of Fig. 1 placed upside down on a hard-wearing outer skin 10 which is cut somewhat larger than the inner lining 3. If required, a layer of thermal insulating material (not shown) may be cut to size slightly less than that of the inner lining 3 and placed between the outer skin 10 and inner lining 3. The edges of the outer skin 10 are then folded over and double stitched all the way round.

Fig. 3 shows the mitten folded so as to bring together thumb portions 11, 12 at which the connections 5 are soldered or otherwise joined together. The edges 13, 14 are stitched together, and may be bound, to provide the final mitten form.

Fig. 4 shows the mitten cuff on which a strain relief clamp 15, pushed over the cable 8, is pressed through the material layers.

The mitten is heated by supplying A.C. or D.C. low voltage electrical current to the terminals 4.

In an example, current is supplied at 28 volts and the article consumes 20 or 12 watts. In another example, current is supplied at 12 volts and the article consumes 12 watts, this example being more suitable for use with a completely portable power supply such as a battery pack.

Fig. 5 shows an alternative method of connection to a metallised fabric heating element 2. A tape 16 of metallised fabric having a higher metallic loading, i.e. of lower resistivity, is used to bind an edge 17 of the heating element fabric 2. Multifilament copper wires 18 may be laid over the binding 16 and parallel to the edge 17. The wires 18 may be stitched in place, as indicated at 19, and a connecting wire 20 is electrically connected to the heating element fabric 2 by a rivet 21 passing through the wire 20, the copper wire 18, both layers of binding tape 16 and the element itself.

The metallised fabric circuit gives the user not only an overall even temperature distribution but it also

concentrates more heat into particular areas. It is a well documented physiological fact that under cold conditions the thumb and first fingers suffer. The design of the circuit takes into account this fact, reduction of the surface area of the metallised material in the vulnerable areas providing more localised heat. The resistance of the mitten is the series resistance of the elemental parts. The heat produced is proportional to I^2R if the applied voltage is constant. Therefore, if the resistance of elemental paths is higher in the thumb and first finger regions, the power dissipated is higher in those areas. The resultant temperatures in the mitten are fairly constant over the mitten but are slightly higher in the areas required.

Extra heating can be produced if the metallised fabric characteristics make is stretchable. The resistance changes as the material is deformed. Therefore, if this material is incorporated in the mitten, flexing produces more heat.

CLAIMS

1. An electrically heated fabric article having an interlining of flexible metallised fabric providing a resistance heating element shaped so as to be capable in use of generating for each point on a surface of the article, an amount of heat substantially corresponding to the heat requirements at that point.

2. An electrically heated fabric element as claimed in claim 1, wherein the heating element is in the form of one or more direct paths between terminals supplying the heating current.

3. An electrically heated fabric article as claimed in claim 1, wherein the heating element is in the form of one or more sinuous indirect paths between terminals supplying the heating current, the paths being defined by providing slits or other narrow openings in the flexible metallised fabric interlining.

4. An electrically heated fabric article according to any one of claims 1, 2 or 3, wherein the flexible metallised fabric interlining is of substantially constant thickness and the resistance from point to point is varied by variation in width of the interlining.

5. An electrically heated fabric element as claimed in any one of claims 1, 2 or 3, wherein the flexible metallised fabric interlining is of substantially constant thickness and the resistance from point to point is varied by variation in the metallic loading of the interlining.

6. An electrically heated mitten or other garment substantially as described with reference to the accompanying drawings.

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